

# **Code 582**

Flight Software Branch

## FSB Requirements and Guidelines for Electrostatic Discharge (ESD) Control of ESD-Sensitive (ESDS) Devices Within Sustaining Engineering Laboratories

Flight Software Branch – Code 582

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## FORWARD AND UPDATE HISTORY

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This document establishes requirements and guidelines for Electro-Static Discharge (ESD) control within the NASA Goddard Space Flight Center Flight Software Branch Sustaining Engineering Laboratories.

Version	Date	Description	Affected Pages
1.0	01/29/07	Initial release	All

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## 1 PURPOSE

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The Code 582 Flight Software Branch (FSB) uses specialized electronic equipment in the process of the development and maintenance of flight software. In accordance with GPR 8730.6, Electrostatic Discharge Control, and GSFC-WM-001, GSFC Workmanship Manual for Electrostatic Discharge Control, this document establishes the minimum necessary controls for protecting ESD sensitive devices in the FSB sustaining engineering laboratories.

## 2 SCOPE

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This document applies to the flight software sustaining engineering laboratories controlled by the FSB and personnel handling ESD sensitive devices in these laboratories.

### 3 RESPONSIBILITIES

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This section describes the responsibilities for each position associated with the laboratories.

#### **3.1 ESD Officer**

The ESD Officer is responsible for:

- (1) The overall implementation and compliance of ESD requirements.
- (2) Providing assistance to Laboratory Managers in resolving issues related to compliance to this procedure and GSFC-WM-001.

#### **3.2 Laboratory Manager**

Laboratory Managers are responsible for:

- (1) ESD operations for each laboratory within their respective branch/office.
- (2) Implementing the requirements of this document in their laboratory.
- (3) Seeking assistance from Code 561/564 on technical issues.

#### **3.3 Operator**

Operators are responsible for following the requirements of this document, specifically section 6.3.

#### **3.4 Technician**

Technicians are responsible for following the requirements of this document, specifically section 6.4.

## 4 DEFINITIONS

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This section provides definitions as needed for this document. Additional definitions of ESD terms may be found in the references.

**Breadboard** – A breadboard unit, as used in the FSB, provides a sufficient representation of the flight data system hardware in terms of functionality and interfaces. However, it most likely differs significantly in physical representation. Unlike Engineering Test Units, breadboards are not typically enclosed in a Faraday cage.

**Certification** – The act of verifying and documenting that personnel have completed required training, demonstrated specified proficiency, and met specified requirements.

**Continuous Monitoring System (CMS)** – a device used to monitor the continuous grounding of an individual's wrist strap and the station's work surfaces. The device will provide both an audible and visual alarm if this ground is broken.

**Controlled Area** – An area that is constructed and equipped with the necessary ESD-protective materials and equipment to limit ESD voltage below the sensitivity level of the devices that are handled therein. The ESD-controlled areas shall be labeled as such.

**Electrostatic Charge** – An electric charge on the surface of an object.

**Electrostatic Discharge (ESD)** – A transfer of electrostatic charge between bodies at different electrostatic potentials caused by direct contact or induced by an electrostatic field.

**Engineering Test Unit (ETU)** – An Engineering Test Unit is flight equivalent hardware. It should be nearly identical both functionally and physically. ETUs are typically enclosed in a Faraday cage.

**Faraday Cage** – a conductive enclosure that prevents entry or escape of a stationary electrostatic field.

**Flight Data System Hardware** – a hardware electronic component that is qualified for flight. The FSB uses breadboards and Engineering Test Units to test software intended for these processors.

**Flight Software Sustaining Engineering Laboratory** – an area in which equipment resides for the purpose of maintaining a set of flight software for a post-launch mission. The central components of these laboratories may be ETUs and/or bread-boarded versions of flight data system hardware, which may be housed either in equipment racks or on tables. Support equipment, such as those used for communication with and commanding of these components, are also part of the laboratory.

**Ground** – A mass such as Earth or a vehicle hull capable of supplying or accepting a large electrical charge.

**Handle or Handling** – Actions in which devices are hand-manipulated or machine-processed during actions such as inspecting, manufacturing, assembling, cleaning, staging, testing, repairing, reworking, maintaining, installing, transporting, failure analyzing, wrapping, packaging, marking, or labeling.

**Operator** – A person who uses the laboratory for its intended purpose, which is typically testing of modification to flight software. An operator may interact with sensitive devices to the extent of

setting switches or connecting cables, but will not perform maintenance such as that requiring removal of circuit boards.

Technician – A person who performs maintenance on ESD sensitive devices. A technician is usually in the laboratory for a brief period of time. This is often to extract devices for repairs to be done in another facility.

## 5 REFERENCES

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- (1) GSFC-WM-001, GSFC Workmanship Manual for Electrostatic Discharge Control.
- (2) GPR 8730.6, Electrostatic Discharge Control.
- (3) ANSI/ESD S20.20-1999, Requirements for Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies, and Equipment (Excluding Electrically Initiated Explosive Devices).
- (4) NASA-STD-8739.7, (Cancelled) Requirements for Electrostatic Discharge Control.



## **6 PROCEDURE**

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### **6.1 General**

Within the laboratories, ESD sensitive devices are handled by Operators (turning on switches, mate/demate cables, etc.) or technicians (i.e., removing/installing/troubleshooting, etc.). The following sections provide the details for safeguarding ESD sensitive devices in the laboratories.

### **6.2 General Laboratory Requirements**

#### **6.2.1 Laboratory Access**

Only authorized personnel will have access to the laboratory.

#### **6.2.2 Location of ESD Sensitive Devices**

All ESD sensitive devices will reside either in a grounded equipment rack or in an ESD protected area. All ESD sensitive devices entering or leaving the laboratory must be enclosed in a Faraday cage or ESD protective bag/container.

#### **6.2.3 ESD Signage**

- (1) Equipment racks containing ESD sensitive devices will be identified by ESD signage.
- (2) Permanent work areas designated for hardware troubleshooting will be properly identified by ESD signage and boundary tape.
- (3) Work tables with permanent ESD sensitive hardware will be identified with ESD signage and boundary tape.

#### **6.2.4 Wrist Straps**

- (1) Wrist straps shall be provided for all laboratory personnel that need to access ESD sensitive devices.
- (2) A wrist strap checker shall be provided for the laboratory if a continuous monitoring system (CMS) is not utilized.
- (3) Wrist straps shall be located such that they can be put on prior to accessing ESD sensitive devices.
- (4) Wrist strap checkers and logs shall be located outside of the ESD controlled area, but such that they are easily accessible prior to entry to the area. A sample wrist strap log is provided in Section 7.

- (5) Wrist strap grounding shall be to the equipment rack, work surface, or CMS as appropriate to the laboratory.

### **6.2.5 Temperature and Humidity**

- (1) All laboratories shall monitor temperature and relative humidity levels with a calibrated hygrometer.
- (2) Temperature and humidity readings will be recorded daily (manually or automatically).
- (3) A history of temperature and relative humidity readings shall be available.
- (4) A humidity and temperature log shall be located outside of the ESD controlled area, but such that it is easily accessible prior to entry to the area. A sample humidity and temperature log is provided in Section 7.
- (5) The relative humidity levels SHALL be maintained in ESD controlled areas at an ideal range of 40% to 60% and a maximum range of 30% to 70%. Humidifiers should be implemented as needed to keep humidity within this range.
- (6) Work within ESD controlled areas shall be halted if the humidity level falls below 30%.

### **6.2.6 ESD Training**

All personnel handling ESD sensitive devices shall have a current training certification to one of the following:

- (1) GSFC-WM-001, GSFC Workmanship Manual for Electrostatic Discharge Control
- (2) NASA-STD-8739.7, Requirements for Electrostatic Discharge Control

### **6.3 Operator Activities**

Operators needing to access equipment racks, which contain ESD sensitive devices, will adhere to the following requirements:

- (1) Check wrist strap with a calibrated wrist strap checker and record the results if a CMS is not used.
- (2) Use wrist strap connected to a ground point or CMS.
- (3) Monitor temperature and humidity readings.
- (4) Record temperature and humidity readings daily when handling of ESD sensitive devices is to occur. Contact laboratory manager if readings are out of specification.
- (5) Discharge (ground) any cables during mate/demate operations except during testing in which cables are energized.

- (6) Use care in keeping prohibited items at least 1 meter away from ESD sensitive devices. Prohibited items include food and drink; clipboards, books, notebooks, loose sheets of paper used to read or record data or follow instructions (unless enclosed in ESD safe bags or totes); "Tacky Mats" as those used at the entrance to Clean rooms, CRT displays, and other equipment which generates static charge. Generally, materials unessential to the operation of the equipment and not known to be specifically made and verified to be ESD safe should be considered prohibited.

#### **6.4 Technician Activities**

Technicians that are removing, installing, or troubleshooting ESD sensitive devices will adhere to the requirements in section 6.3 and the following:

- (1) Wear an ESD approved protective smock (garment). Smocks should have bloused cuffs.
- (2) Provide appropriate equipment, including a portable ESD field kit (with roll up mat and wrist strap) or portable work bench as needed.
- (3) Transport all ESD sensitive hardware to and from the laboratory in a Faraday cage or ESD protective bag/container.

During maintenance, Laboratory Managers may provide equipment and assistance to technicians in order to establish additional ESD protective measures as needed.

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## 8 RECORDS

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- (1) Wrist Strap Check Log – Completed logs will be kept by the ESD Officer for a period of 5 years.
- (2) Temperature/Humidity Log – Completed logs will be kept by the ESD Officer for a period of 5 years.